PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference GB020006	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)

International application No. PCT/GB 03/01504	International filing date *(day/month/year)* 08.04.2003	Priority date *(day/month/year)* 04.12.2002

International Patent Classification (IPC) or both national classification and IPC
G06F9/46

Applicant

INTERNATIONAL BUSINESS MACHINES CORPORATION et al.

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

    ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

    These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

    I   ☒   Basis of the opinion

    II   ☐   Priority

    III ☐   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

    IV   ☐   Lack of unity of invention

    V   ☒   Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

    VI   ☐   Certain documents cited

    VII ☐   Certain defects in the international application

    VIII ☐   Certain observations on the international application

Date of submission of the demand 16.05.2003	Date of completion of this report 27.05.2005

Name and mailing address of the International preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Wierzejewski, P Telephone No. +31 70 340-4974

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB 03/01504

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-5, 8-11	as originally filed
6, 7	received on 14.03.2005 with letter of 14.03.2005

Claims, Numbers

10, 11	as originally filed
1-9	received on 14.03.2005 with letter of 14.03.2005

Drawings, Sheets

1/6-6/6	as originally filed

2. With regard to the **language,** all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐   the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐   the language of publication of the international application (under Rule 48.3(b)).

   ☐   the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐   contained in the international application in written form.

   ☐   filed together with the international application in computer readable form.

   ☐   furnished subsequently to this Authority in written form.

   ☐   furnished subsequently to this Authority in computer readable form.

   ☐   The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐   The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐   the description,   pages:

   ☐   the claims,   Nos.:

   ☐   the drawings,   sheets:

5. ☐   This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-9
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following document:
   D1: US 2002/169775 A1 (MENG FRANK) 14 November 2002 (2002-11-14)

INDEPENDENT CLAIMS 1,5

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sence of article 33(2) PCT.

   The document D1 discloses (the references in parentheses applying to this document):

   a method of synchronization for use in a distributed data processing system comprising: at least one legacy computer (paragraph 6, method [...] synchronization") *having means for storing a master version of data* (paragraph 15; "[...] database system includes a source database"), *a first non-legacy computer* (paragraph 15; "mirror database") *having means for supporting synchronization* (paragraph 15; "The mirror database replicate data received from the mobile clients to the source database"), *and a second non-legacy computer* (paragraph 15, "mobile client") *having means for storing a copy of said master version of data and means for executing at least one operation on said copy* (implicit from paragraph 15, "Mobile clients perform transactions [on a local copy of database" and **then** synchronize the transactions with a corresponding mirror database"; paragraph 5; "A three-tier distributed database consists of mobile client **databases**"), *said method comprising the steps of: executing, by said second non-legacy computer, said at least one operation on said copy* (paragraph 15, "Mobile clients perform transactions [on the mobile client]"), *sending, by said second non-legacy computer, said at least one operation to said first non-legacy computer* (paragraph 16; "When a mobile client database performs synchronization with a corresponding mirror database, a set of client database operations is sent to mirror database"), *executing, by said first non-legacy computer, said at least one operation on said master version at said at least one legacy computer* (paragraph 15, "The mirror databases replicate data

received from mobile clients to the source database"; paragraph 16, "During replication, these operations are transmitted from the mirror database to the source database"), *determining if said executing step is successful* (paragraph 20, "In this case, no conflict is detected"; paragraph 16, "the results are returned to the mobile clients", nb. paragraphs 18-20 describe in detail the step of determining whether the proposed operations can be executed on master version;), *in response to a successful executing step, synchronizing said master version by applying said at least one operation* (paragraph 20, "the invention knows the proposed mobile transaction can be performed [...]"; paragraph 16, "During replication, these operations are transmitted from the mirror database to the source database") *and sending, by said first non-legacy computer, the results from said executing said at least one operation on said master version step and a new copy of the master version of data* (paragraph 16, "[...] the results are returned to the mobile clients"; paragraph 6, "[...] mobile-based proposed transaction or synchronization [...]".)

3. Claim 5 merely contains the features of claim 1, being expressed in system terms. Therefore, because of the reasons similar to those described above, claim 5 is not new either (Article 33(2) EPC).

DEPENDENT CLAIMS 2-4, 6-8

4. The features of dependent claims 2-4 and 6-9 are not new either (Article 33(2) PCT), as they are also disclosed by D1, namely:

4.1 The feature of claims 2 and 6, as far as understood: sending, by second non-legacy computer, a synchronization protocol to the first non-legacy computer (paragraph 6, "mobile-based proposed [...] synchronization"; nb. paragraph 6 summarizes a synchronization protocol).

4.2 The feature of claims 3 and 7: two or more operations being executed by said first non-legacy computer (paragraph 18, "for example, mirror database includes two pending database changes").

4.3 The feature of claims 4 and 8: master version is not synchronized if execution has not

succeeded (paragraph 20, "when the token returns to the mirror database [...] the transaction is rolled back because the roll flag is set 'YES'.").

INDEPENDENT CLAIM 9

5.   Claim 9 merely contains the features of claims 1-4, being expressed in computer program terms. Therefore, because of the reasons similar to those described above, claim 9 in not new either (Article 33(2) EPC).

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memory permits the processing of the client request to be decoupled from the updating of the back-end processing system.

Thus there is a need for a model that provides the benefits of the data synchronization model and the "n-tier" model, without the need for extensive change of the "n-tier" model.

Disclosure of the Invention

According to a first aspect, there is provided a method of synchronization for use in a distributed data processing system comprising: at least one legacy computer having means for storing a master version of data, a first non-legacy computer having means for supporting synchronization, and a second non-legacy computer having means for storing a copy of said master version of data and means for executing at least one operation on said copy, said method comprising the steps of: executing, by said second non-legacy computer, said at least one operation on said copy, sending, by said second non-legacy computer, said at least one operation to said first non-legacy computer, executing, by said first non-legacy computer, said at least one operation on said master version at said at least one legacy computer, determining if said executing step is successful, in response to a successful executing step, synchronizing said master version by applying said at least one operation, and sending, by said first non-legacy computer, the results from said executing said at least one operation on said master version step and a new copy of the master version of data.

Thus, once the at least one operation has been executed on the legacy computer, the first non-legacy computer sends the results (i.e. success/failure notification as well as the resulting data itself) and a new copy of the master version of data to the second non-legacy computer.

As an example, the legacy computer is a mainframe computer, the fist non-legacy computer is a web application server and the second non-legacy computer is a PDA. Preferably, the method further comprises the step of: sending, by the second non-legacy computer, a synchronization protocol to the first non-legacy computer. The protocol will typically be particular to the type of second non-legacy computer. In a preferred embodiment, if there are two or more operations to be executed on the legacy computer, the operations are executed in sequence. Preferably, if the at least one operation cannot be executed on the master version (e.g. because of conflicting concurrent operations), master version is not synchronized.

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According to a second aspect, there is provided a distributed data processing system for synchronization comprising: at least one legacy computer having means for storing a master version of data, a first non-legacy computer having means for supporting synchronization, and a second non-legacy computer having means for storing a copy of said master version of data and means for executing at least one operation on said copy, said system further comprising: means for executing, by said second non-legacy computer, said at least one operation on said copy, means for sending, by said second non-legacy computer, said at least one operation to said first non-legacy computer, means for executing, by said first non-legacy computer, said at least one operation on said master version at said at least one legacy computer, means for determining if said executing step is successful, means, responsive to successful determination, for synchronizing said master version by applying said at least one operation, and means for sending, by said first non-legacy computer, the results from said means for executing said at least one operation on said master version and a new copy of the master version of data.

According to a third aspect, there is provided a computer program comprising computer program code means adapted to perform all the steps of the above method when said program is run on a computer.

Brief Description of the Drawings

The present invention will now be described, by way of example only, with reference to preferred embodiments thereof, as illustrated in the following drawings:

FIGURE 1 is a schematic representation of a prior art "n-tier" model:

FIGURE 2 is a schematic representation of a prior art data synchronization model;

FIGURE 3 is a schematic representation of an "n-tier" model, in accordance with the present invention;

FIGURE 4 is a flow chart showing the operational steps involved in a data synchronization process, implemented in the model as shown in FIGURE 3;

FIGURE 5 is a sequence diagram of the flows involved in the data synchronization process between the components in the model as shown in FIGURE 3; and

FIGURE 6 is a representation of the results of data synchronization.

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CLAIMS

1.   A method of synchronization for use in a distributed data processing
system comprising: at least one legacy computer having means for storing a
master version of data, a first non-legacy computer having means for
supporting synchronization, and a second non-legacy computer having means
for storing a copy of said master version of data and means for executing
at least one operation on said copy, said method comprising the steps of:

    executing, by said second non-legacy computer, said at least one
operation on said copy,

    sending, by said second non-legacy computer, said at least one
operation to said first non-legacy computer,

    executing, by said first non-legacy computer, said at least one
operation on said master version at said at least one legacy computer,

    determining if said executing step is successful,

    in response to a successful executing step, synchronizing said
master version by applying said at least one operation, and

    sending, by said first non-legacy computer, the results from said
executing said at least one operation on said master version step and a
new copy of the master version of data.

2.   A method as claimed in claim 1, further comprising the step of:
sending, by the second non-legacy computer, a synchronization protocol to
the first non-legacy computer.

3.   A method as claimed in claim 1 or claim 2, wherein said at least one
operation comprises two or more operations and said operations are
executed by said first non-legacy computer sequentially.

4.   A method as claimed in claim 1, wherein in response to an
unsuccessful executing step, the master version is not synchronized.

5.   A distributed data processing system for synchronization comprising:
at least one legacy computer having means for storing a master version of
data, a first non-legacy computer having means for supporting
synchronization, and a second non-legacy computer having means for storing

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a copy of said master version of data and means for executing at least one operation on said copy, said system further comprising:

means for executing, by said second non-legacy computer, said at least one operation on said copy,

means for sending, by said second non-legacy computer, said at least one operation to said first non-legacy computer,

means for executing, by said first non-legacy computer, said at least one operation on said master version at said at least one legacy computer,

means for determining if said executing step is successful,

means, responsive to successful determination, for synchronizing said master version by applying said at least one operation, and

means for sending, by said first non-legacy computer, the results from said means for executing said at least one operation on said master version and a new copy of the master version of data.

6.   A system as claimed in claim 5, further comprising: means for sending, by the second non-legacy computer, a synchronization protocol to the first non-legacy computer.

7.   A system as claimed in claim 5 or claim 6, wherein said at least one operation comprises two or more operations and said operations are executed by said first non-legacy computer sequentially.

8.   A system as claimed in claim 5, wherein in response to an unsuccessful determination, the master version is not synchronized.

9.   A computer program comprising computer program code means adapted to perform all the steps of claims 1 to 4 when said program is run on a computer.